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AN INDEPENDENT ESTIMATE OF SELECTED COSTS OF THE HEAVY LIFT HEL--ETC(U)
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AN INDEPENDENT ESTIMATE

OF

SELECTED COSTS OF THE HEAVY LIFT HELICOPTER

19 AUGUST 1974

DCA-R-4

DIRECTORATE OF COST ANALYSIS

OFFICE OF THE COMPTROLLER OF THE ARMY

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This document presents an estimate of selected costs for the development, production, and operation of the Heavy Lift Helicopter (HLH) for consideration during the ASARC process in early FY 75. Because of stringent time constraints imposed on this analysis, the cost estimates have been limited to those cost elements which are either high in dollar amount or which appear to be areas where significant contributions can be made. This report, due to the grossness of the costs presented, also attempts to specify confidence levels in the costs and to indicate the sensitivity of the estimates to possible changes.

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AN INDEPENDENT ESTIMATE OF SELECTED COSTS OF THE HEAVY LIFT HELICOPTER

I. INTRODUCTION

1. Purpose. This paper presents an estimate of selected costs for the development, production, and operation of the Heavy Lift Helicopter (HLH) for consideration during the ASARC process in early FY 75. The Director of Cost Analysis (DCA), COA, was asked by ASA(FM) to prepare a gross cost estimate which can then be compared, by the ASARC, to the AMC field estimates. A study team from the System Estimates Division (SED) of DCA was tasked to prepare the cost estimate.

2. Scope.

a. Because of the stringent time constraints imposed on this analysis, the cost estimates have been limited to those cost elements which are either high in dollar amount or which appear to be areas where significant contributions can be made. Cost elements which have not been examined in detail are specified in Tables 3 and 4, Appendix A, and include the associated costs provided in the AMC Independent Parametric Cost Estimate (IPCE) and the Project Manager's Baseline Cost Estimate (BCE) for a production quantity of 100 HLH. No study team cost estimates have been prepared for those cost elements since they are either low in dollar value or the AMC IPCE and Project Manager's BCE rationale for the costs appear to be reasonable.

b. This paper, due to the grossness of the cost presented, will also attempt to specify confidence levels in the costs and to indicate the sensitivity of the estimates to possible changes.

c. The DCA plan is to fully develop and test a helicopter cost model before it is used for a weapon system which would be going for an ASARC decision. However, full model development was not possible prior to this HLH estimate, and we are, accordingly, presenting at this time an analysis of selected elements of the total cost structure.

d. The scope of the study precluded addressing a number of issues which are candidates for further analysis. These were:

(1) Reaggregating weapon system costs into program acquisition costs, procurement unit costs, flyaway costs, and hardware costs.

(2) Establishing relationship to SAR costs.

(3) Identifying costs currently in budget and planning documents, other than those specifically mentioned in the study.

(4) Estimating the impact of PM revised escalation factors resulting from the Assistant Secretary of Defense Memorandum, 30 July 1974, subject: "Major Program Acquisition Cost Estimates," except as indicated in the aircraft airframe production CER. The costs associated with different inflation indices are shown for the airframe production as an example of the cost impact of the cited memorandum.

e. For ease of understanding, sufficient documentation has been included in this study so that the costs which have been estimated can be easily followed. One separate document, HLH company composition (to include maintenance detachment) by LTC Norman Axe, is available in SED for review by interested personnel. Figure 1 portrays the life cycle cost of a weapon system. Figure 2 gives the matrix into which the AMC IPCE and Project Manager's BCE costs have been structured for simplicity in this study.

3. <u>Approach</u>. The study team approach to estimating the cost of the HLH involved the following:

a. Examination of all available CER's for R&D and production of helicopter airframes and engines (this includes CER's in the Baseline Estimate and AMC IPCE).

b. Development of a new airframe slope CER for production costs.

c. Use of the Army Life Cycle Cost Model (matrix), as shown in Figure 2.

d. Conduct of sensitivity analyses to determine ranges of cost impacts due to possible changes in the system program.

e. Documentation of study team cost estimates.

4. <u>Acknowledgements</u>:

a. SED study team personnel who participated in this paper and their areas of interest were:

LTC Jesse H. Martin	Team Leader
Mr. Noel Summers	Tactical Military Personnel
LTC Norman Axe (MOBDES)	Tactical Military Personnel
Mr. Karl Seiler & Mr. Richard Brannon	Methodology and Aircraft Airframe Production CER
LTC William S. Clough & MAJ James Schroeder	Editorial Comment

b. The study team also wishes to acknowledge the help of HQ AMC and AVSCOM Cost Analysis personnel who provided advice and assistance during the study.

LIFE CYCLE OF A WEAPON SYSTEM

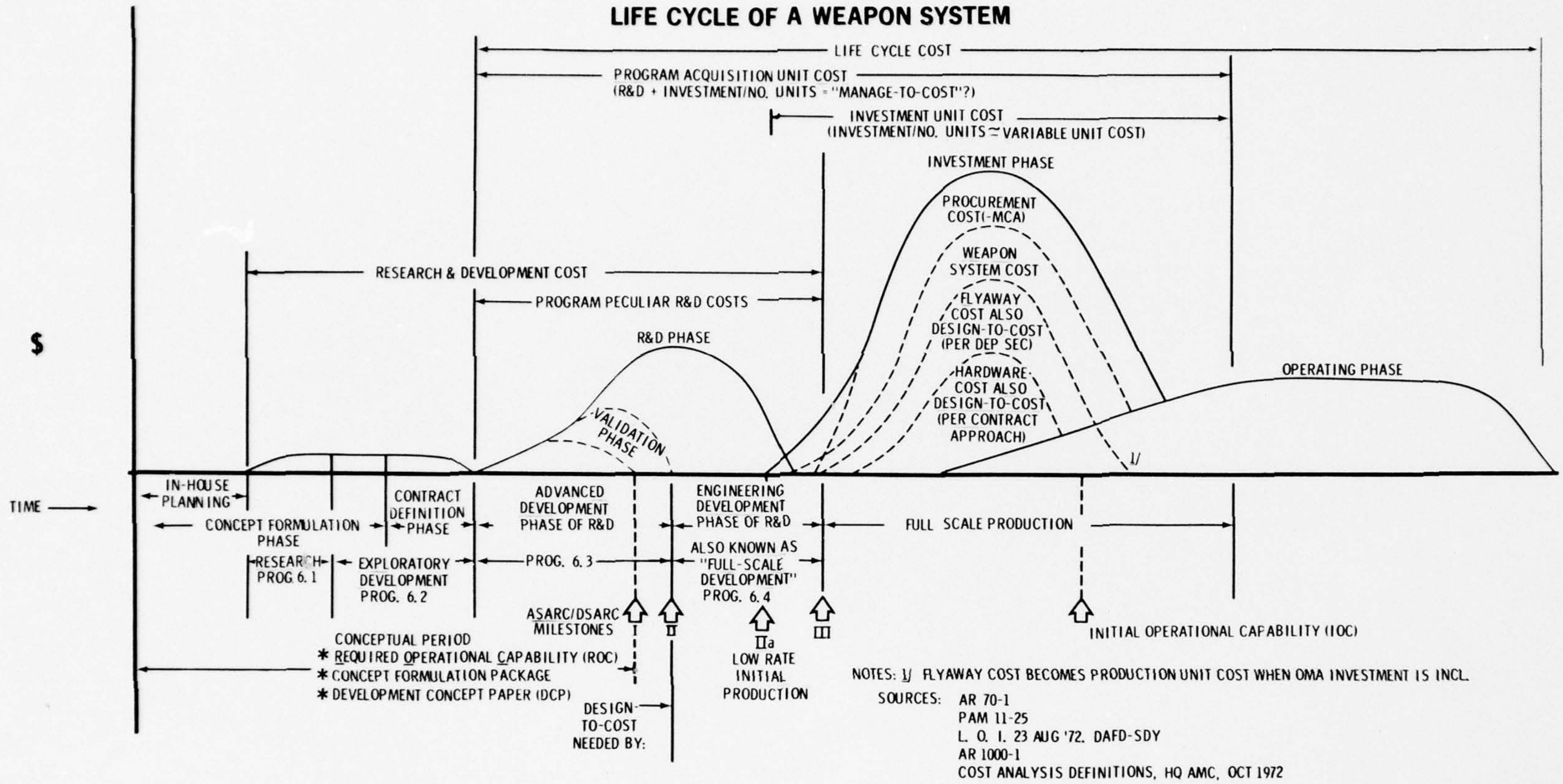

Figure 1

ARMY LIFE CYCLE COST MODEL

ROW	APPROP	DEFINITION REF	WBS / COST ELEMENT	FRAME (1)	PROPULSION (2)	GUIDANCE & CONTROL/ COMMO EQUIP (3)	PAYLOAD/ AMMUNITION (4)	FIRE CONTROL EQUIP (5)	ARMAMENT (6)	PECULIAR SUPPORT EQUIP (7)	COMMON SUPPORT EQUIP (8)	SYSTEM COMMON/ OTHER (9)	TOTAL (10)	% (11)
1	—	1.0	**RESEARCH & DEVELOPMENT**											
2	—	1.01	ENGINEERING											
3	RDTE	1.011	Contractor											
4	RDTE	1.012	Gov't (In House)											
5	RDTE	1.02	TOOLING											
6	—	1.03	PROTOTYPE PRODUCTION											
7	RDTE	1.031	Contractor											
8	RDTE	1.032	Gov't (In House)											
9	—	1.04	SYSTEMS TEST & EVALUATION											
10	RDTE	1.041	Contractor											
11	RDTE	1.042	Gov't (In House)											
12	RDTE	1.05	DATA											
13	—	1.06	SYSTEMS MANAGEMENT											
14	RDTE	1.061	Contractor											
15	RD OMA	1.062	Gov't (In House)											
16	—	1.07	CONSTRUCTION											
17	RDTE	1.071	Industrial Facilities											
18	MCA	1.072	Military Construction											
19	RDTE	1.08	TRAINING											
20	—	1.09	OTHER											
21	RDTE	1.091	Contractor											
22	RD OMA	1.092	Gov't (In House)											
23	—	2.0	**INVESTMENT**											
24	PROC	2.01	PRODUCTION BASE SPT (NON-R)											
25	—	2.02	ENGINEERING (R)											
26	PROC	2.021	Contractor											
27	PROC	2.022	Gov't (In House)											
28	—	2.03	QUALITY CONTROL (R)											
29	PROC	2.031	Contractor											
30	PROC	2.032	Gov't (In House)											
31	—	2.04	DATA (R)											
32	P OMA	2.041	Contractor											
33	P OMA	2.042	Gov't (In House)											
34	—	2.05	PRODUCTION (R)											
35	PROC	2.051	Contractor											
36	PROC	2.052	Gov't (In House)											
37	—	2.06	INITIAL PROVISIONING (R)											
38	P OMA	2.061	Contractor											
39	P OMA	2.062	Gov't (In House)											
40	—	2.07	MODIFICATIONS (R)											
41	PROC	2.071	Contractor											
42	PROC	2.072	Gov't (In House)											
43	—	2.08	SYSTEMS MANAGEMENT (R)											
44	PROC	2.081	Contractor											
45	P OMA	2.082	Gov't (In House)											
46	—	2.09	CONSTRUCTION (SITE & NON SITE)											
47	MCA	2.091	Contractor											
48	MCA	2.092	Gov't (In House)											
49	P OMA	2.10	TRANSPORTATION (R)											
50	—	2.11	TRAINING (R)											
51	PROC	2.111	Contractor											
52	P OMA	2.112	Gov't (In House)											
53	—	2.12	OTHER											
54	PROC	2.121	Contractor											
55	P OMA	2.122	Gov't (In House)											
56	—	3.0	**OPERATING**											
57	MPA	3.01	TACTICAL MILITARY PERSONNEL											
58	—	3.02	CONSUMPTION											
59	P OMA	3.021	Replenishment Spares											
60	OMA	3.022	POL											
61	P OMA	3.03	TRANSPORTATION											
62	—	3.04	DEPOT MAINTENANCE											
63	P OMA	3.041	Contractor											
64	P OMA	3.042	Gov't (In House)											
65	—	3.05	MODIFICATIONS											
66	P OMA	3.051	Contractor											
67	P OMA	3.052	Gov't (In House)											
68	P OMA	3.06	OTHER DIRECT SUPPORT OPNS											
69	—	3.07	INDIRECT SUPPORT OPNS											
70	P OMA	3.071	Central Supply											
71	P OMA	3.072	OTHER											
72	—		**TOTAL SYSTEM COST (LESS AEC)**											
73	—		**AEC COST**											
74	—		**TOTAL SYSTEM COST (WITH AEC)**											

100%

Figure 2

II. FACTORS IMPACTING COST ANALYSIS

1. System Description and Requirements.

a. System Description:

(1) Aircraft:	Weight
Design mission gross weight	120,764 lbs
Design payload (HOGE SL/95°)	45,000 lbs
Design mission fuel	11,385 lbs
Fixed useful load (includes 5 man crew)	1,842 lbs
Empty weight	64,545 lbs
AMPR weight	62,556 lbs
Max alternate gross weight	148,000 lbs
(2) Propulsion:	
Number of engines	3
Engine type	T701-AD-700 Turboshaft
Combiner Transmission rating (HP)	17,700
AFT/FWD Transmission rating (HP)	10,620
Max single engine rating (HP)	8,078
Integral fuel capacity (gal)	3,092
Integral fuel capacity (lbs)	20,100
(3) Rotors:	
Number	2
Diameter (feet)	92.0
Tip speed (fps)	750.0

Disc loading (PSF) at DGW	8.9
Blade area (at 153 sq ft each)	1,224.0
Geometric solidity ratio	.09226
Geometric disc area (2 at 6647.6 sq ft)	13,295.00

b. Requirements:

Crew size	5
Procurement quantity	75 or 100
Number of prototypes	1 or 2
Number of static test articles	1
Number of operating yrs of HLH fleet	10 or 15 yrs
Aircraft per HLH company	9
Personnel per HLH company	170
Personnel per maintenance team (to be added to HLH company)	82

2. Costing Assumptions and Ground Rules.

a. Assumptions:

(1) That study team cost estimates should be prepared for production buy quantities of both 100 and 75. The quantity of 100 aircraft was selected since both the AMC IPCE and Project Manager's Baseline Cost Estimate (BCE) were initially developed based on a production buy of 100 and then adjusted for buys of 50 and 250. The quantity of 75 was selected since this is now projected (as of 9 August) as the most likely production quantity for the HLH.

(2) That the effective rate of production per month for the HLH would be a weighted average of the low rate initial production (LRIP) and full scale production (FSP) rates as follows (per AVSCOM's latest estimate, 8 August 1974):

	75 AIRCRAFT		100 AIRCRAFT	
	Rate	Quantity	Rate	Quantity
LRIP	0.37	10	0.30	11
FSP	1.25	65	1.20	89

(3) That the operating cost for the HLH fleet should be computed on the basis of both 10 years and 15 years of full fleet operation. Ten operating years was selected so that the ASARC can compare the study team costs to either the AMC IPCE or the Project Manager's BCE. Fifteen operating years was also selected since Army experience shows an effective helicopter life of 15 years, and this permits the ASARC to compare the CAA COEA 15-year fleet operating cost figures to those in this paper, as well as to the 10-year operating costs shown in the AMC IPCE and Project Manager's BCE.

(4) That the cost estimates for certain other cost elements were probably reasonably accurate since the data base used for the estimates was adequate and the methodology employed had merit.

b. Ground Rules.

(1) All data and requirements used in this paper are as currently known on 9 August 1974. No changes to the system parameters or the data base after 9 August 1974 were permitted (time constraint).

(2) Only key costs for the HLH system were examined in detail (time constraints).

(3) The tactical military personnel costs are computed based upon an organic HLH company and an attached maintenance detachment since the HLH fleet will operate under an aviation company concept.

(4) The cost impact of changes to the estimated production cost of the helicopter airframe were also reflected in changes to the initial spares and replenishment spares costs for the helicopter airframe, using the same cost factors employed by AMC in the IPCE.

(5) Low dollar value cost elements were not examined in detail. A criterium of 2% of total life cycle cost was used as the cutoff point (i.e., for 100 aircraft buy, 2% of approximately $2,500 million, or $50M, was used).

(6) Minor arithmetic corrections were made to the AMC IPCE. This amounts to $4.0 million in FY 74 dollars and causes the slight difference in totals between the amounts shown for AMC in this paper and those shown in the AMC IPCE. No corrections were made to the Project Manager's Baseline Estimate.

3. Data Normalization and Cost Escalation.

a. Data Normalization. Data was normalized for use in the HLH airframe production CER as indicated in that discussion, Chapter III, para 1.

b. Cost Escalation. As indicated in Chapter III, para 1 and 5c, the cost data used in the HLH airframe production CER was escalated from FY 72 to FY 74 dollars at a different rate than that used by AMC.

III. SELECTED ANALYSES

1. Airframe Production CER: Methodology and Results.

a. Approach. The approach taken in general reflects the application of operations research principles to the ordinary regression analysis performed in the IPCE for predicting the learning curve slope. The coefficient of correlation, r, is the objective function to be maximized in an optimization procedure to be described. The optimal value of r is derived first from a formal search procedure considering a wide range of parameters. This is followed by an iterative process in which the implicit values of the independent variable exponents are relaxed. The ordinary rectangular regression bias is then removed by constructing an orthogonal regression line through the data field. By maximizing the coefficient of correlation using the techniques just described, there is created a truly better least squares fit to the data, hence less error and therefore improved predictive capability.* The final result sought is an improvement in the least squares fit of the relationship between airframe production cost and a related set of explanatory variables.

b. Methodology.

(1) Assumptions.

a. That the CER used to predict the first unit airframe cost in the AMC IPCE is valid.

b. That the sample base represents costs which have been uniformly and realistically normalized for the effects of inflation through the year FY 72.

c. That the sample base represents a period of time during which the technological approach to the fabrication of both rotary wing and fixed wing aircraft has remained constant.

d. That the sample base accurately reflects all of the non-cost parameters used; namely, AMPR weight, average rate of production per month by lot, and lot production quantities.

---

*It is assumed that the true functional relationship between the dependent and independent variables is best described by that mathematical function which produces the minimum sum of least squares, ceteris paribus.

(2) Decription of Independent Variables Used. There were two basic independent variables used: rate of production per month, and AMPR weight. The time available for further research into other possible cost drivers precluded the use of other than these two basic variables. With these two basic variables, however, five additional forms were derived and used in an overall optimization matrix. The seven independent variable hypotheses tested then were:

(a) $\hat{\bar{R}}$ = average rate of production per month weighted by each lot quantity

(b) R min = minimum rate of production occurring in any month

(c) W = AMPR weight

(d) $\hat{\bar{R}}$,W = multiple correlation

(e) $\hat{\bar{R}}$.W = product form

(f) $\hat{\bar{R}}$/W = quotient form

(g) W/$\hat{\bar{R}}$ = quotient form

(3) Description of Mathematical Forms Used. There are six basic mathematical forms used as obtained on the General Electric time sharing statistical package. Here again, other forms could not be investigated because of the time constraint. The six mathematical form hypotheses tested were:

(a) $a + b\,x$

(b) ax^b

(c) ae^{bx}

(d) $1/(a + bx)$

(e) $x/(ax+b)$

(f) $a + (b/x)$

(4) Listing of Sample Sets Used. Four sample sets were chosen for this analysis. The four sample set hypotheses tested were:

(a) Four Rotary Wing

UH1
SH3
CH47
CH53

(b) Five Rotary Wing

UH1
OH6
SH3
CH47
CH53

(c) Five Rotary Wing + Four Fixed Wing

UH1
OH6
SH3
CH47
CH53
KC135
C124
C130
C141

(d) Five Rotary Wing + Five Fixed Wing

UH1
OH6
SH3
CH47
CH53
C133
KC135
C124
C130
C141

(5) Search Matrix for Optimal Solution. By combining the dimensions of investigation outlined in the previous sections (2), (3), and (4), there is formed a 7 X 6 X 4 matrix of possible solutions (7 independent variable forms, 6 mathematical forms, and 4 sample formats.) The objective of this step is to identify the maximum r.

(6) Independent Variable Exponential Relaxation. Having identified the optimal solution consistant with a reasonable level of degrees of freedom, the next step in the optimization procedure is to proceed to relax the implicit values of the independent variable exponents.

Recall that the coefficient of correlation is measured by*

$$r = \sqrt{1 - \frac{\Sigma\ (Y - Yc)^2}{\Sigma\ (Y - \bar{Y})^2}} \qquad \text{where} \qquad (1)$$

Y = point value of Y

Yc = computed (line) value of Y

$\bar{Y}$ = mean of the Y distribution

To maximize r, the ratio $\Sigma(Y-Yc)^2 \ / \ \Sigma(Y-\bar{Y})^2$ must be minimized. This ratio, however, is a function of the rate of change between Y and X (the slope).

$$\Sigma(Y-Yc)^2 \ / \ \Sigma(Y-\bar{Y})^2 = f\ (dY/dX) \qquad (2)$$

To change dY/dX, the implicit exponent of X_i is relaxed to permit r to be maximized using ordinary rectangular regression methods. The initial exponential relaxation of X_i is determined by comparing σ_Y with σ_{Xi}. Therefore, σ for all X_i is needed.

If, $\sigma_Y > \sigma_{Xi}$

the implicit exponent α of Xi is initially made some arbitrary value $1.0 < \alpha < 2.0$ and r is measured again noting the effect of the initial exponentiation. If r has increased, the exponent is again arbitrarily increased still further using the Newton-Raphson iterative gradient technique until r has been maximized (subject to a digital accuracy constraint). * *

If r had decreased initially, the initial relaxation of α would have been iteratively reduced until r had been maximized (subject to the same constraint).

* F. E. Croxton, D. J. Cowden, "Applied General Statistics", Prentice Hall 1951.

** Further insight into the subject of truncation of a converging series may be found in "Numerical Mathematical Analysis", J. B. Scarborough, The John Hopkins Press, 1966.

If however,

$$\sigma_y < \sigma_{Xi}$$

the implicit exponent α of X_i would have been initially made some arbitrary value $0 < \alpha < 1.0$ and the same iterative process carried out as before.

The same procedure is followed for all X_i. The result then is a series, X_i^{α} , X_j^{B}, ... $i = 1 \ldots n, j = 1 \ldots n$

(7) Returns to Scale

If,

$$\alpha = 1.0$$

the returns to scale are constant, meaning that changes in any of the independent variables (input factors) will result in proportionate changes in the dependent cost variable (output factor).

If,

$$\alpha > 1.0$$

the returns to scale are said to be increasing, meaning that changes in any of the input factors will result in a more than proportionate increase in the output factor, cost.

If,

$$\alpha < 1.0$$

the returns to scale are said to be decreasing, with the opposite meaning of that expressed previously.

(8) Orthogonal Translation. It is assumed that all of the correlations performed in the preceding optimization procedures were based on ordinary least squares Y on X rectangular regressions. It can be shown that regressing Y on X will produce a regression line (assuming linearity) lower in slope than if the regression were performed by regressing X on Y. It can further be shown that both forms of rectangular regressions are biased and in opposite direction.* Slope bias is, of course, of added significance when extrapolating beyond the data field.

* Klein, Lawrence R., "Textbook of Econometrics", Evanston: Row, Peterson & Co. 1953.

By regressing orthogonally the biases are effectively canceled.*

The orthogonal curve is readily derived by geometrically interpolating between the Y on X curve and the X on Y curve. First, a plot of the equations for both Y on X and X on Y is made. In general, it will be found that there is a crossover in the vicinity of the mode of the X distribution. The orthogonal curve is constructed by connecting the median points between the Y on X and the X on Y curves. The orthogonal curve can also be derived trigonometrically; however, for most applications the geometric interpolation is simpler to do and sufficiently accurate.

c. Results. The initial results using the 7 X 6 X 4 search matrix are presented first, followed by the exponential relaxation results, the orthogonal translation result, and finally the cost impact.

(1) Four Rotary Wing Aircraft. The sample of four rotary wing aircraft, chosen from the same units used in the AMC IPCE (the UH1, SH3, CH47, and the CH53) in general produced unacceptable results using all six of the mathematical forms in regressing slope as a function of either $\hat{\bar{R}}$ or R min. The minimum value of r, -0.933, occurred when regressing $\hat{\bar{R}}$ using $1/(a+bx)$ and when regressing R min using $a+(b/x)$. The maximum, but theortically unacceptable value of r+0.988 occurred when regressing R min using either ae^{bx} or $1/(a+bx)$. While the results with a negative r appear "good" they are also unfortunately unacceptable. The rejection of the negative r results is based on the observation that while there appear to be four data points, there are in effect only two, because of extreme clustering. The distribution is highly bimodal and that is the underlying reason why all of the r values are high. In this case the fitting process involves establishing a line of best fit between essentially only two points. In effect, there are no degrees of freedom left.

At this point it was decided to reject the investigation of the other five independent variables using this sample. The reasons for this decision are twofold: First, the time constraint, and second, the extreme bimodality in the dependent variable (slope) would have an undesirable effect on any further regression analyses with whatever independent variables that were chosen.

---

* Regressing Y on X assumes that X is known with certainty and that all the error is due to the uncertainty in measuring Y; the converse is assumed when regressing X on Y; regressing Y orthogonally on X assumes that both Y and X are measured with uncertainty.

(2) Five Rotary Wing Aircraft. The sample of five rotary wing aircraft was derived by adding the OH6 to the previous sample, since there was no logical reason to exclude it. A graphical analysis of this addition revealed, however, that the biomodolity of the slope data was essentially unchanged. For the reasons cited previously, this sample was also abandoned and no regression analyses were performed.

(3) Five Rotary Wing + Four Fixed Wing Aircraft. This sample represents the identical sample used in the HLH AMC IPCE. The r obtained in the AMC HLH IPCE was -0.669 based on a multivariate regression using the mathematical form of aR^bW^c where R is the arithmetic mean of the monthly rates of production, W is the AMPR weight, and a,b, and c are the parameters to be estimated. The same sample using $\hat{R}$ by itself in lieu of R, however, produced a maximum r of -0.696 when using either of the mathematical forms a+bx or ax^b. The variable W by itself produced extremely poor results with a maximum r of -0.176. The product of $\hat{R}$ and W also failed to surpass the AMC IPCE result for all six mathematical forms. At this point it was decided to reject the investigation of the other three independent variable forms: $\hat{R}$, W; $\hat{R}$ /W; W $\hat{R}$. The reasons for this decision are twofold: First, the time constraint, and second, the residual opportunity to use all seven of the independent variable forms when using a sample of ten.

(4) Five Rotary Wing + Five Fixed Wing Aircraft. This sample was derived by adding the C133 to the AMC IPCE data set. Although only 38 of these aircraft were produced (the reason the AMC IPCE deleted it), it definitely has the rate of production per month of interest; namely, unity. For this reason it was decided to include the C133 in the sample. Of the 42 possible cases to examine (7 independent variables and 6 mathematical forms) only two were not completed because of the time constraint. These were: $\hat{R}$, W using the form $ae^{b\hat{R}}CW$ and $\hat{R}$, W using the form $\hat{R}$ /($a\hat{R}$+b). Of the 40 cases tried, the maximum r produced was -0.733 using $\hat{R}$,W in the form $a\hat{R}^bW^c$.

(5) Summary of Search Matrix Results. Of the 168 possible cases in the 7X6X4 matrix, 80 were tested. Of the 80 cases tested, the optimum r-0.733 was obtained using the sample of ten in a multivariate regression of the form $a\hat{R}^bW^c$.

(6) Summary of Independent Variable Exponential Relaxation. In log form the previous result was obtained by:

$\ln S = (\ln a) + (b \ln \hat{R}) + (c \ln W)$. In this step, it is assumed that a,b, and c are indeed optimal in terms of maximizing r under the constraint that the implicit exponential values of the independent variables are unity. The constraint is then removed by introducing the exponent α as follows:

$$\ln S = \ln a + b\,(\ln \hat{R})^{\alpha} + c\,(\ln W)^{\alpha}$$

The optimizing value of α was 0.63 which produced a maximum r of -0.746.

(7) Summary of Orthogonal Translation. All of the previous slopes were obtained using ordinary rectangular regression methods with the slope S_r as the dependent variable. By regressing orthogonally, the endemic bias associated with the ordinary rectangular regression is removed. The orthogonal form S_o of the slope equation is:

$$S_o = -22.99 + 1.253 * S_r$$

where $\ln S_r = 4.88979 - .0890835(\ln R)^{.63} - .0736331(\ln W)^{.63}$

R = production rate in airframes per month

W = AMPR weight in pounds

The expression $S_r = e^{\ln(S_r)}$ can be used to find S_r, given $\ln(S_r)$. Unfortunately, extrapolation beyond the sample data in the range from 0 to 1.0 production unit per month using the above S_o equation produced irrational slopes (>100%). This curvature anomaly was corrected by erecting a straight line proceeding from the origin (100% slope at 0 rate of production) to a point which is tangent to the derived curve.

(8) Cost Impact - 75 buy, low inflation rates. Using the following assumptions:

(a) 1st 10 units to be produced at an average production rate of 0.37 per month using a 99.2% learning curve.

(b) Next 65 units to be produced at an average production rate of 1.25 per month using a 92.2% learning curve.

(c) No adjustment for automatic flight control, advanced materiels, or expected value.

(d) AMC IPCE inflation rates to adjust FY 72 to FY 74 aircraft PEMA costs of 5.6%.

The resultant costs are:

1st	10 units @	$16.54M	ea. =	$165.4M
next	65 units @	9.38	ea. =	643.1
TOTAL	75 units @	10.78	ea. =	808.5

(9) Cost Impact- 75 buy, realistic inflation rates. Using the same assumptions as in (a), (b), and (c) above, except for (d) where the inflation rate is increased to 13.3% to adjust FY 72 to FY 74 aircraft PEMA costs, the realistically inflated costs are approximated by adding 7.7% (13.3% - 5.6%) to the costs in (8) above, as follows:

1st	10 units @	17.81M	ea. =	$178.1M
next	65 units @	10.65	ea. =	692.5
TOTAL	75 units @	11.61	ea. =	$870.6

(10) Cost Impact - 100 buy, low inflation rates. Using the following assumptions:

(a) 1st 11 units to be produced at an average production rate of 0.30 per month using a 98% learning curve.

(b) Next 89 units to be produced at an average production rate of 1.20 per month using a 92.4% learning curve.

(c) No adjustment for automatic flight control, advanced materials, or expected value.

(d) AMC IPCE inflation rates to adjust FY 72 to FY 74 aircraft PEMA costs of 5.6%, the resultant costs are:

1st	11 units @	$15.85M	ea. =	$174.4M
next	89 units @	8.96	ea. =	797.2
TOTAL	100 units @	9.72	ea. =	971.6

(11) Cost Impact - 100 buy, realistic inflation rates. Using the same assumptions as in (a), (b), and (c) above, except for (d) where the inflation rate is again increased to 13.3% for the reason cited earlier, the realistically inflated costs are approximated by again adding 7.7% to the costs in (10) above, as follows:

1st	11 units @	$17.07 M	ea. =	$187.8 M
next	89 units @	9.65	ea. =	858.6
TOTAL	100 units @	10.46	ea. =	1046.4

d. Conclusions:

(1) That the AMC IPCE airframe CER estimate of $833 million for 100 HLH's is probably too low.

(2) That the slope CER outlined in this section predicts a cost of 972 million for 100 HLH's using the same low rate of inflation indices and the same first unit cost as used in the AMC IPCE.

(3) That the slope CER outlined in this section produces a superior statistical base for cost prediction.

(4) That the major portion of the cost increase shown above (1046 million -833 million = 213 million for 100 HLH's) is due to the use of the improved slope CER, the balance of the increase is due to the use of the more realistic inflation rates.

(5) That fixed wing aircraft apparently can be included in a data base for predicting the airframe cost of a helicopter the size of the HLH.

e. Recommendation. That the production cost estimate of 1046 million dollars for 100 HLH airframes be used in lieu of the AMC IPCE estimate of 833 million (before adjustments for automatic flight control, advanced materials, and expected value).

2. Alternate Airframe Production CER: Methodology and Results.

a. The above approach is a procedure where cost is considered to be a function of slope, and slope is treated as a function of weight and rate per month. It can be called indirect because the variable to be estimated (cost) is separated from the cost driving variables. In the above case, the CER predicting slope had to be forced to the origin to permit predictions beyond the data field (area of interest LRPM). It had, however, a correlation coefficient (0.75) higher than that developed in the IPCE (0.67). Cost estimates made by using the above procedure would give narrower confidence intervals than those in the IPCE, but they still would be broader than desired.

b. The approach below predicts cost directly using the historical data (from the AMC IPCE) for nine airframes segregated into 38 individual production lots, together with the cost driving variables of quantity and rate per month. Economic consideration indicates a response surface like Figure 3, for any given weight.

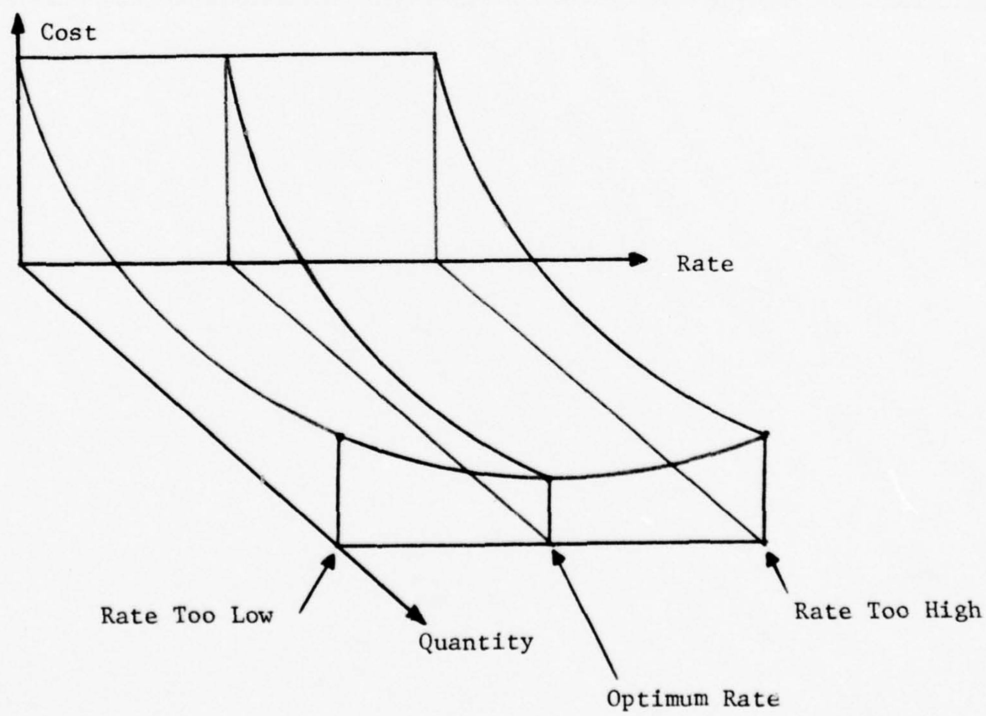

Figure 3

c. If it is assumed that the rate of production for historical programs was either to the left or optimum in Figure 3 (i.e., either too low or about right), and if weight is assumed to dirve the cost, then one choice for a model is:

$$C = a \times Q^b \times R^c \times W^d$$

where

C = Cost

Q = Quantity of airframes

R = Rate of airframe production

W = Weight of airframe

and a, b, c, d are parameters to be estimated. To make sense, a and d should be greater than zero, while b and c should be negative.

d. For this study we measured each variable in several ways, to see which way was the best predictor. The variables and their symbols are:

NAME	DEFINITION
Y 1	Cumulative average cost per airframe in millions of 74 dollars
Y 2	Cumulative average cost per airframe in dollars per pound
Y 3	Y 2 divided by 100
X 1	Cumulative quantity of airframes
X 2	X 1 divided by 10
R 1	Airframes produced per month
R 2	Pounds of airframe produced per month (airframes per month times pounds per airframe)
R 3	Tons of airframe produced per month
R 4	R 3 divided by 100

NAME	DEFINITION
W 1	Airframe weight in pounds
W 2	Airframe weight in tons
W 3	W 2 divided by 10

(1) All the statistical work was accomplished using the natural logarithm of the above variables, denoted here by prefixing "L" to the variable name. As a first step, we calculated the correlation between the independent variables and the dependent variables; the correlations are:

INDEPENDENT VARIABLES

Dependent Variables	LX1	LX2	LR1	LR2	LR3	LR4	LW1	LW2	LW3	ALL
LY 1	-.26	-.26	-.09	+.70	+.70	+.70	.95	.95	.87	.99
LY 2	-.62	-.62	-.53	-.80	-.80	-.80	-.66	-.66	-.52	.94
LY 3	-.62	-.62	-.53	-.80	-.80	-.80	-.66	-.66	-.52	.94

This indicates that Y1 is as easy to predict as Y2 or Y3. Since Y1 is the most convenient form for cost, Y2 and Y3 are not considered further. Also, the most convenient forms for quantity, rate, and weight (i.e., X1, R2, and W1) are correlated with cost at least as well as any other variables. The model them becomes:

$$Y1 = a \times X1^{b} \times R2^{c} \times W1^{d}$$

Estimating a, b, c and d with data from the 38 lot data base gives:

estimate	t-statistic
a = .002921	-19.4
b = -.2315	- 5.7
c = -.0108	- .19
d = .7840	12.1

Note that the estimates have the correct signs, and that the variable for rate has a t-statistic of -.19 which is not statistically significant, when X1 and W1 are in the equation. Also, rate is correlated with weight

(R = .85), a possible problem. Due to the value of c, rate has very little influence on the result. The CER is:

$$Y1 = (.002921) + (X1)^{-.2315} + (R2)^{-.0108} + (W1)^{.7840}$$

where R = .98 and the standard error is .18. These measures of goodness of fit apply only to the logarithmic form of the equation which was:

$$LY1 = a + b \times (X1) + C \times (R2) + d \times (W1)$$

A comparison between the actual and the predicted amounts in the non-log form gives an average error of 13%, the largest errors resulting from one aircraft, the C-124, whose actual cost per unit was lower than the predicted cost.

(2) Next, the actual values for rate and weight are put into the equation. The result is a learning curve CER relating cumulative average cost to quantity. The slope is 85.17% and the theoretical first unit cost is 14.40 million dollars (FY 1974). For 100 aircraft, the cumulative average cost is estimated at 4.89M for a total cost of 488.83M. This is so far below the IPCE estimate (slightly more than half) that we can't accept the results. Three possible reasons have been identified. First, the HLH may not belong to the family of aircraft used in the analysis. The programs closest to the HLH in weight, for example, were all fixed-wing aircraft. Second, the definitions used for the HLH and the other aircraft may be different. Nothing was found, however, that could be used to modify the data base to reduce such differences. Third, the variable for rate as defined in the analysis, may not measure the phenomenon we are trying to evaluate. This last problem is likely, as explained below, but fitting a CER without rate gave almost the same results (a little lower). Fourth, while there are 38 distinct lots, there are only 17 production rates, 9 AMPR weights, and 9 learning curve slopes.

(3) We tried two different approaches to capture the idea of rate of production. The variable R1 uses the number of airframes produced per month. It seems that the raw number of vehicles per month doesn't, by itself, tell whether the rate is too fast, too slow, or just right. The optimum production rate depends on the configuration of the assembly plant and other things. To illustrate, 9 aircraft per month might be a good rate for C-141 aircraft (weight = 104,649 pounds), but much too slow for a UH-1 aircraft (weight: 3,000 pounds). The variable R1 does not measure the difference. Statistics confirm the lack of relationship between vehicles per month and cumulative average cost (r = -.09). The variables R2, R3, and R4 compensate in part for the fact that large aircraft have lower optimum rates than small

aircraft. It measures the amount of activity going on by multiplying aircraft per month times weight per aircraft. This variable is correlated to cumulative average cost ($r = .70$), but is also intercorrelated with weight ($r = .85$). When weight and quantity are in the model, as they should be, the additional contribution made by the variable weight per month is not significant. Also, it has very little impact -- the predicted slopes for the two proposed rates for the HLH are 85.18% and 85.16%. Since economic considerations suggest that rate influences cost, and our estimator influenced cost in the right direction, the variable weight per month (R2) was included in the model. It should be noted that none of the variables considered measure the idea of a relative rate (i.e., too fast, too slow, or just right). This relative rate might depend on plant capacity, number of production lines, number of operating shifts, configuration of the physical plant, weight and size of the aircraft, and perhaps other things. Professional judgment was used to assign the numbers 0 and 1 to each type of aircraft, depending on whether it was produced too slowly or at the right speed (no aircraft was produced to fast). All but the UH-1 were assigned the number "1", and the UH-1 was at the low end of the weight axis, so the use of regression was not appropriate. For further progress, one would need more data on more lots. It would help to have data on labor hours, cost of material, and totals for many different lots and for many different types of aircraft. Perhaps one could define some kind of judgmental quantity which attempts to measure the relative rate. Examples of this are 1) a judgmental variable which takes the values (-1, 0, 1), standing for too slow, just right, too fast, respectively; P, the percentage of plant utilization; R, a ratio of the rate experienced to the rate for which the tooling was made, or some other variable.

e. Each of the two methods has its advantages and its shortcomings. The second or direct method appears to have more potential, since it addresses all the cost drivers at the same time, and it yields both a slope and a first unit cost. It does not yield a plausible result in the present case. While the first or indirect method at least yields a plausible slope, it is somewhat weak for low rates of production. For the HLH study, the first method is preferred.

NOTE: Both of the methods described above are being published as a study for comment by the cost analysis community and as a potential area for further development. We hope that they may lead to further improvement in the state-of-the-art in estimating aircraft airframe production costs.

3. Tactical Military Personnel (Pay and Allowances and PCS Costs).

a. Assumptions.

(1) Heavy Lift Helicopters will be organized into the TRADOC proposed TOE 55-259Q for the Heavy Lift Helicopter (HLH) company with a total strength of 170. The proposed TOE 55-259Q is based on an old CH-54 company (TOE 55-259H) with a total strength of 164. A current change to the CH-54 company TOE reduced its strength to 150 total. However, since TRADOC had increased the old CH-54 company strength for use with the HLH, no adjustments were made to the proposed HLH TOE.

(2) Supporting the HLH company is a maintenance team (TOE 55-570 G7KF) that services the CH-54 company. When TRADOC developed the proposed HLH company TOE, they did not propose any change to the then existing 82-man maintenance team (TOE 55-570G7KF). Therefore, the 82-man maintenance team is used for servicing the HLH company.

(3) CONUS peacetime deployment of all HLH companies.

(4) All costs are in FY 74 dollars.

b. Pay and Allowances. The pay and allowances (MPA) used for the HLH company and maintenance team were obtained by adjusting the costs for TOE 55-529H and TOE 55-570G7KF found in the Force Cost Information System (FCIS) as of May 1974. The specific adjustments required are documented separately in LTC Axe's paper, "Costing of Tactical Military Personnel in Army Life Cycle Cost Model," 1 August 1974. The resultant costs are:

	Strength	Annual Pay and Allowances ($ in thousands)
HLH	170	$1,561
Maintenance Team	82	617
TOTAL	252	$2,178

c. Annual PCS Costs.

(1) The factors for annual PCS costs computations are: (unit officer strength X cost per officer X officer rotation rate) and (unit enlisted strength X cost per enlisted person X enlisted rotation rate).

(2) Reference Summary Cost Data Book for Army Managers, July 1974, for the following factors:

	Officer		Enlisted	
	Cost	Rotation Rate	Cost	Rotation Rate
Intra-CONUS	$2,341	38%	$565	50%

(3) Based on the above, the annual PCS costs for the proposed HLH company (TOE 55-259Q) and the maintenance team (TOE 55-570G7KF) are:

	Officers	Enlisted	Total
TOE 55-259Q	$29,356	$38,703	$68,059
TOE 55-570G7KF	1,779	22,600	24,379
TOTAL	$31,135	$61,303	$92,438*

*A rounded figure of $92,00 will be used in all future computations.

d. Total Annual Tactical Military Personnel Costs. The total annual tactical military personnel costs for the HLH company and maintenance team are summarized below:

	Annual Costs (FY 74 $ in Millions)		
	HLH Company	Mainteance Team	Total
Pay & Allowances	$1.561	$0.617	$2,178
PCS	0.068	0.024	0.092
TOTAL	$1.629	$0.641	$2,270

e. Tactical Military Personnel Costs for 15 Years. The tactical military personnel costs over 15 years for seven HLH companies and maintenance teams (aircraft buy of 75 HLH) are:

	HLH Company	Maintenance Team	Total
Pay and Allowances	$163.905	$64.785	$228.690
PCS	7.140	2.520	9.660
TOTAL	$171.045	$67.305	$238.350

f. HLH Tactical Military Personnel Cost Related to Other Estimates.

(1) Shown below is cost estimate from P.M. BCE of May 1974.

(a) Cost per Aircraft (FY 74 $ in thousands when total buy is 100):

$65.9*	MPAO (Military Pay and Allowance - Officers)
2.6*	PCSO (Permanent Change of Station - Officers)
24.0*	MPAEM (Military Pay and Allowances - Enlisted Men)
0.1*	PCSEM (Permanent Change of Station - Enlisted Men)
40.6**	Field Level Maintenance (Pay, Allowances & PCS)
$133.2	TOTAL

* Extracted from Page 98.

** Computed from Maint equation, page 99, omitting training costs as follows:

Maint = ($8.208 + 0.4 x $0.352 + 0.27 x $10.478) x NUMMEN = $54.3

Solving NUMMEN gives NUMMEN equal to 4.8582; then recalculating Maint omitting training (0.27 x $10.478) gives: Pay, Allow. and PCS = ($8.207 + 0.4 x $0.352) x 4.8582 = $40.6

(b) From page 98 the number of TOE aircraft is 85 for a buy of 100, therefore, the total annual force pay, allowances and PCS costs equals 85 times $133,200 or $11.322 million (FY 74 $).

(2) Shown below is the cost estimate from AMC IPCE of May 1974.

(a) Cost per Aircraft (FY 74 $ in thousands when total buy is 100)

$65.9*	MPAO
2.6*	PCSO
24.0*	MPAEM
0.1*	PCSEM
45.2**	Field Level Maintenance (Pay, Allowances and PCS)
$137.8	TOTAL

* Extracted from Page 100.

** Computed from Maint equation, Page 100, omitting training costs as follows. Solving the Maint equation for NUMMEN gives NUMMEN equal to 5.4129; then recalculating Maint Maint omitting training gives: Pay, Allow, and PCS = ($8.207 + 0.4 x $0.352) x 5.4129 = $45.2.

(b) From Page 94 the number of TOE aircraft is 85 for a buy of 100, therefore, the total annual force pay, allowances, and PCS costs equals 85 times $137,800 or $11.713 million (FY 74 $).

(3) Shown below is the cost estimate from CAA COEA of 28 June 1974.

(a) Total Annual Tactical Military Personnel Costs (FY 74 $ in millions).

$1.515*	HLH Company (TOE 55-259Q)
0.590**	Maintenance Team (TOE 55-570G7KF)
$2.105	TOTAL

* $1.461 x 1.037 as shown in Table I-3, page I-5, VOL II, Appendix I.

** From Mr. Gray, CAA.

(b) For a buy of 100 aircraft and with nine aircraft in the proposed HLH company, it is assumed that nine HLH companies will be formed. Therefore, the total force annual tactical military personnel costs equals nine times $2.105 million or $18.945 million (FY 74 $).

(c) From VOL II, page III-4, CAA took the approach of using a % increase in strength $(\frac{170}{164} = 1.037)$ times AFPCH CH-54 company personnel costs.

A comparison of this approach versus the by-grade change method that we used follows: Current FCIS CH-54 company (160 men) MPA - Other x Factor $(\frac{170}{160})$ = $1.488 million x 1.0625 = $1.581 million vs. $1,561,062 or 1.24% increase over the by-grade method.

(4) Table 1 summarizes the comparison of the above HLH tactical military personnel costs on an annual, 10-year, and 15-year basis.

TABLE 1

HLH TACTICAL MILITARY PERSONNEL COST COMPARISON
(FY 74 $ in Millions)

	Aircraft Quantities		Annual Cost	10-Year Total Cost	15-Year Total Cost
	Buy	TOE			
PM Baseline	100	85	$ 11.322	$113.220	$169.830
AVSCOM IPCE	100	85	11.713	117.130	175.695
CAA COEA	100	81	18.945	189.450	284.175
Study Team IPCE	100	81	20.430	204.300	306.450
Study Team IPCE	75	63	15.890	158.900	238.350

g. Conclusions.

(1) That tactical military personnel costs should be shown for a full HLH operating fleet period of a minimum of 15 years.

(2) That a 15-year operating cost of $238.35 million for an HLH production quantity of 75 aircraft is a realistic cost figure.

(3) That the AMC IPCE and PM Baseline Operating Cost Estimates are understated for a production quantity of 100 HLH.

h. Recommendation. That the figure of $238.35 million be used to evaluate the cost impact of the HLH operating fleet for a procurement quantity of 75 aircraft.

4. HLH Operating Costs (Less Tactical Military Personnel) :

a. The following adjustments would have to be made to HLH fleet operating costs, other than tactical military personnel and replenishment spares, to reflect a fleet operating life of 15 years for 75 and 100 aircraft.

	10 Operating Yrs.		15 Operating Yrs.	
	(Costs in millions of FY 74 dollars)			
	75 HLH *	100 HLH	75 HLH	100 HLH
PM Baseline & AMC IPCE	$110.2M	$148.6M	$165.3M	$222.9M

(1) AMC IPCE and P.M. Baseline costs which are shown above for 10 and for 15 operating years for 100 HLH consist of:

	10 Yrs.	15 Yrs.
POL	$87.6M	$131.4M
Transportation	4.7M	7.0M
Depot Maintenance	38.5M	57.8M
Central Supply	17.8M	26.7M
TOTAL	$148.6M	$222.9M

(2) AMC IPCE and P. M. Baseline costs which are shown above for 10 and for 15 operating years for 75 HLH consist of:

	10 Yrs.	15 Yrs.
POL	$65.0M	$97.5M
Transportation	3.5	5.2
Depot Maintenance	28.5	42.8
Central Supply	13.2	19.8
TOTAL	$110.2M	$165.3M

b. Replenishment spares costs for the HLH, as computed in the AMC IPCE (for 100 HLH), is based on a CER which allowed for an HLH empty weight of 62,120 pounds and has been accepted as a reasonable estimate at this time. Time constraints precluded development of an alternate CER. However, it is necessary to compute an estimated cost for a production quantity of 75 HLH and for 15 operating years as well as the standard 10 year operating period.

* Costs for the production quantity of 75 HLH are computed based on the AMC IPCE and P.M. Baseline estimates of $.1749M per year per operating aircraft. Seven HLH companies of 9 aircraft each, or 63 operating aircraft were used to compute these costs. The cost elements are as broken out above.

(1) Replenishment spares cost for 10 operating years for 75 and 100 HLH: Estimated yearly cost per aircraft $.3349M (FY 74 dollars)

$.3349M X 85 operating aircraft X 10 years = $284.7M

$.3349M X 63 operating aircraft X 10 years = $211.0M

(2) Replenishment spares cost for 15 operating years for 75 and 100 HLH:

$.3349M per aircraft per year X 85 aircraft X 15 years = $427.0M

$.3349M per aircraft per year X 63 aircraft X 15 yrs. = $316.5M

5. HLH Initial Provisioning, Airframe.

a. Due to the changed estimate for HLH airframe production costs, the initial provisioning estimate for aircraft airframe should be adjusted as follows (for production of 75 HLH):

New airframe production cost estimate (Chapter III, para 1 (75 HLH)	$872.4M	FY 74 dollars
Initial provisioning percentage*	X 20%	
Revised estimate for initial provisioning	$174.5M	
Other airframe provisioning	+9.9	
MAD provisioning	+2.3	
Total airframe & components	$186.7M	FY 74 dollars

b. For a production quantity of 100 HLH, the aircraft airframe initial provisioning estimate would have to be adjusted as follows:

New airframe production cost estimate (Chapter III, para 1) (100 HLH)	$1053.2M	FY 74 dollars
Initial provisioning percentage*	X 20%	
Revised estimate for initial provisioning	$210.6M	
Other airframe provisioning	+13.2	
MAD provisioning	+ 3.1	
TOTAL	$226.9M	FY 74 dollars

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* AMC used a percentage of 20% for airframe spares (20% X 910.1M = 182.0M for 100 aircraft) and 22% for other airframe items (22% X 60.0M = 13.2M) and MAD equipment (22% X 14.1M = 3.1M). For simplicity, the study team applied the 20% factor to the study team estimates for 75 and 100 aircraft. The AMC IPCE figure of 910.9M for 100 aircraft is adjusted from their CER generated estimate of $833.3M, as shown in their IPCE.

c. When a more realistic inflation rate is used to convert from FY 74 dollars, the computations for 75 and for 100 HLH production quantities are changed as follows (FY 74 dollars):

(1)	Production cost for 75 HLH:	\$936.5M
	Initial provisioning %	20%
	Initial provisioning	\$187.3M
	for other airframe	+9.9M
	added for MAD	+2.3M
	Total airframe	\$199.5M
(2)	Production cost for 100 HLH	\$1130.5M
	Initial provisioning %	20%
	Initial provisioning	\$226.1M
	for other airframe	+13.2M
	added for MAD	+ 3.1M
		\$242.4M

d. The net effect of the application of the new inflation guidance is to increase the cost of spares for the basic airframe by 7.7% (for 100 HLH, it increases from \$210.6M to \$226.1M in FY 74 dollars).

6. Cost Elements with adequate Data Bases and Valid Methodology. The CER's developed for the AMC IPCE show a very high level of ingenuity and professionalism. As stated in the AMC IPCE, the limitations result mostly from the large differences between the HLH and the existing aircraft which comprise the data base, with respect to the large size, the low production rate, and the use of advanced materials. The usual data problems exist; e.g., existing data for engine R&D reflect the cost of modifying previous engines, not development of new ones. Discussion of individual CER's and other relevant cost elements follows. (See Table 2, and paragraphs III.1. and III.4. for the estimated costs associated with these cost elements).

a. Airframe R&D. Of the ten data points, the costs for four appear to come from contractor proposals, and for four others it is not clear whether actual or proposed data was used. Only rotary wing types were included, making extrapolation beyond the data base necessary. The adjustments and the final results are reasonable, but should be used with caution.

b. Propulsion R&D. The propulsion R&D estimate is based essentially on an engineering approach. The basic premise is that the HLH engine is not a completely new developmental effort. Under the circumstances, the derivation of the estimate for engine R&D can be accepted as reasonable; however, development of a more parametric approach to derive engine R&D costs would help to verify this estimate and to raise the confidence level in it.

TABLE 2

COST ELEMENTS WITH ADEQUATE DATA BASES AND VALID METHODOLOGY
(Costs in millions of FY 74 dollars)

LIFE CYCLE PHASE		COST ELEMENT	AMC IPCE			BASELINE		
			CLASSIC W/R&M	CLASSIC W/O R&M	LRIP	CLASSIC W/R&M	CLASSIC W/O R&M	LRIP
R&D	(a)	Engineering, Contractor, Airframe	$326.4	$326.4	$323.0	$326.4	$332.7	$314.8
	(b)	Engineering, Contractor, Propulsion	111.5	111.5	93.5	111.5	114.2	93.5
	(c)	Prototype Production, Contractor, airframe	101.8	101.8	34.3	97.9	99.5	34.3
	(d)	Prototype, Production, Contractor, Propulsion	28.8	28.8	9.8	29.2	30.0	9.8
INVESTMENT (100 Aircraft)			CLASSIC	LRIP		CLASSIC	LRIP	
	(a)	Production Base Support, (non-R), Airframe	88.9	94.5		98.0	112.0	
	(b)	Production, Contractor, Propulsion	95.5	121.2		86.0	108.6	
	(c)	Production, Contractor, Common Support Equipment	65.6	68.3		59.0	59.0	
	(d)	Initial Provisioning, Contractor, Propulsion	86.0	109.0		77.0	97.7	

c. Prototype Production, Airframe. The cost estimate for the prototype aircraft airframes (the 3 "Y" prototypes and the second "X" prototype) are derived differently: 1) the second "X" prototype is based on analogy to the first "X" prototype and 2) the 3 "Y" prototypes are assumed to have a unit cost equal to the cost of the first production unit. The data used to compute the second "X" prototype cost is based on contract information. The approach for the 3 "Y" model prototypes is a method which has been used previously. While both methods have merit, a more parametric approach to verify the estimates would be desirable. The study team CER approach does indicate that the unit cost estimate is relatively reasonable (see paragraph III.1.)

d. Prototype Production, Propulsion. As in the case with the prototype airframe cost estimate, the method used to derive prototype propulsion costs is to assume that the prototype engines will have a cost which can be derived from the engine production CER, using a different learning curve slope (95%). Under the circumtances (time limitations for analysis) this appears to be a reasonable approach. See paragraph III.6. g for a discussion of the propulsion production CER and data base.

e. Airframe Non-Recurring Investment. Documentation is adequate, but shows that only five data points were used, of which have costs derived from contractor's proposals. This shows a weakness in the Army data base. Three of the data points have a much lower weight than the HLH, and two fixed wing have a much greater weight. This type of sample always shows a high index of determination (R^2), but the results are not meaningful because of the bimodality of the distribution. As stated in the IPCE, the uncertainty associated with the result is high. A more comprehensive data base would raise the confidence in this estimate.

f. Airframe Recurring Investment. Documentation is good, the quantity and type of aircraft are suitable, and the results are reasonable and useful. The study team believes the approach developed in paragraph III.1 represents an improvement to the professional effort of the IPCE.

g. Engine Recurring Investment. The data sources are identified as offices at AVSCOM and an office under USAF. It would be preferable to have the document cited (DD form number, CIR report, etc.), in order to permit evaluation of the quality of the data. The data base contains only engines whose shaft horsepower is much less than that of the HLH. The AMC IPCE also used the analogy approach, which gave similar results and tend to confirm the CER results. The IPCE results is reasonable and useful.

h. Production, Common Support Equipment. The basic method employed to estimate the cost of support equipment was to apply a cost factor (in this case it was 6%) to system hardware costs. This method, and the percentage employed, were based on previous studies in this area.

i. Initial Provisioning, Propulsion. An engineering build-up approach, based on cost studies of the AAH and UTTAS, was apparently used to develop a cost factor (in this case it was 90% - 50% whole engine spares and 40% engine repair parts) which was then applied to the engine hardware costs. The computations used to calculate the 90% cost factor were not documented. Further studies are required in this area to determine realistic cost factors for engine initial spares. Until such studies are conducted, the 90% cost factor will have to be accepted.

j. Replenishment Spares. Although the data is given, the origin is not stated, other than to reference an AVSCOM CER. Four small and two large rotary wing aircraft make up the sample. This type of sample always shows a high R^2 because of its bimodality, but the results are not always meaningful. Since data for other models exists, it could have been used. Also, since the HLH frame is larger, and includes the cargo handling system and fly-by-wire; and since the HLH has three engines instead of one or two (as in the data base), this CER may not be wholly appropriate here. When time and data become available, it would be valuable to address frame and engine spares separately. In addition, spares for avionics and other components should be addressed. PEMA parts, such as the blades, are high cost items which could have been included here, expressed as an accrued cost per flying hour. If this cost is included elsewhere, this fact should be stated. Until better data is available, the results will have to be accepted. Chapter III, Para 4a, shows operating cost calculations for this cost element.

k. Transportation to Depot. Documentation is adequate, but the HLH falls outside the data base. The CER does not consider the average distance to the overhaul facility, a possible shortcoming. The relative size of this cost element (0.3% of life cycle cost) does not warrant further refinement. See Chapter III, Para 4a, for operating cost discussion.

l. Depot Maintenance Manhours. The data for maintenance manhours required for the various data points is from the Logistics Performance Measurement and Evaluation System (LPMES), based on a one-and-one-half year sample. The traditional approach used by the IPCE yields a reasonable and useful number, however. See Chapter III, Para 4a, for operating cost calculations.

IV. ANALYSES IN CONTEXT

1. Review of Analyses of Selected Costs.

a. Since the overall purpose of this study was to analyze as many of the key cost elements for the HLH as time permitted, it is important then to review the benefits that were derived from the analysis of selected HLH costs. The benefits are:

(1) A CER cost estimate with a higher level of confidence was developed for the HLH airframe production.

(2) A second CER approach to estimating aircraft airframe production costs was explored and published for further state-of-the-art development.

(3) A more appropriate approach to costing tactical military personnel was provided.

(4) A cost estimate was provided for a production of 75 aircraft.

(5) The cost impact of the higher historical inflation rates (experienced in the aircraft industry from FY72 to FY74) on the HLH airframe production costs and for the initial provisioning was calculated.

(6) The additional costs associated with increasing the HLH fleet operating life from 10 to 15 operating years was calculated.

(7) Certain weaknesses in current data bases and methodology state-of-the-art were amplified.

(8) The sensitivity of the HLH life cycle costs to cost increases/decreases was explored. Further discussion of these sensitivities is contained in Chapter IV, Para 2.

b. Along with the benefits derived from preparing this paper are certain deficiencies/limitations:

(1) Time constrained a more thorough study of all cost elements.

(2) Time prevented further pursuit of ways to improve the alternate CER so that it could be used to validate, or improve the estimate of, the airframe production costs.

(3) The validity of all data used in the AMC IPCE and the Project Manager's BCE could not be confirmed.

(4) The full cost impact of critical technological developments required for an operational HLH could not be determined. Principal technical areas

which appear particularly sensitive to cost change are:

(a) Combiner box.

(b) New materials.

(c) New rotor blade.

(d) Bonded airframe.

(e) Fly-by-wire electronic control system.

(f) Overall size and weight of the aircraft.

These technological factors are addressed in the sensitivity analysis, below, as an unknown increase/decrease cost impact.

2. <u>Sensitivity Analysis</u>. The sensitivity of the cost estimates described herein to cost increase or decrease would appear to lie largely in three areas: a) range of values around the point values (expected values) of the airframe production CER for production quantities of both 75 and 100 HLH, b) technical uncertainties in the HLH developmental program, and c) changes in the number of HLH fleet operating years.

a. Range of values around the point values (expected values) of $1130.5M for 100 HLH and $936.5M for 75 HLH.

	75 HLH	100 HLH
Point value (expected value)	$ 936.5M	$1130.5M
+ 20% (upper limit)	1123.8M	1356.6M
- 10% (lower limit)	842.9M	1017.5M

b. Technical uncertainties in the HLH developmental program cannot be estimated at this time in terms of overall cost increase or decrease to the total HLH life cycle cost. If there were cost impacts, however, it is more probable that they would cause cost growth.

c. Changes in the number of HLH fleet operating years would be expected to result in a corresponding increase or decrease in total operating costs of approximately $64.0M per year in FY74 constant dollars for 100 HLH and $47.0M per year in FY74 constant dollars for 75 HLH.

V. FINDINGS AND PRINCIPAL CONCLUSIONS

1. Certain cost elements may be 10%, or more, higher than shown in the AMC Independent Parametric Cost Estimate (IPCE) and the Project Manager's Baseline Cost Estimate (BCE). These selected costs are: a) HLH airframe production cost, b) HLH airframe initial provisioning (initial spares), c) tactical military personnel, and d) all other operating costs.

2. The estimates derived herein for selected costs for the HLH for production quantities of 75 and 100 can be used to evaluate the AMC Independent Parametric Cost Estimate (IPCE) and the Project Manager's Baseline Cost Estimate (BCE).

3. The HLH fleet operating costs should be evaluated on the basis of both 10 operating years and 15 operating years.

4. The ASARC can use the cost totals shown below to verify the AMC IPCE and Project Manager's BCE currently available for a production quantity of 100 aircraft:

AMC IPCE as adjusted by Study Team Estimate (100 HLH)
(in millions of FY74 dollars)

	10 OPERATING YEARS		15 OPERATING YEARS	
	Classic R&D	LRIP	Classic R&D	LRIP
R&D AMC IPCE	\$ 684.0M	\$ 546.2M	\$ 684.0M	\$ 546.2M
Investment				
AMC IPCE	457.7	538.8	457.7	538.8
(less airframe)				
(& initial prov)				
Study Team:airframe estimate	1130.5*	1130.5*	1130.5*	1130.5*
Study Team:airframe init. prov.	242.4	242.4	242.4	242.4
Operating AMC/Study Team except tactical military personnel & replenishment spares	148.6(AMC)	148.6(AMC)	229.9(Study Team)	222.9(Study Team)

(Continued)

	10 OPERATING YEARS		15 OPERATING YEARS	
	Classic R&D	LRIP	Classic R&D	LRIP
Study Team-Tactical military personnel	$ 204.3	$ 204.3	$ 306.5	$ 306.5
AMC/Study Team-replenishment spares	284.7(AMC)	284.7(AMC)	427.0(Study Team)	427.0(Study Team)
LCC TOTAL**	$3152.2M	$3095.5M	$3471.0M	$3414.3M

* $1130.5M consists of CER results of $1046.4M + $48.0M (to allow for new material and MAD) = $1094.4M X 1.033 (to adjust for range of values from -10% to + 20%) = $1130.5M.

** These costs may be compared with AMC's IPCE totals found in Appendix B.

P.M. BCE as adjusted by Study Team Estimate (100 HLH)
(in millions of FY74 dollars)

	10 Operating Years		15 Operating Years	
	Classic R&D	LRIP	Classic R&D	LRIP
R&D-P.M. BCE	\$ 676.9M	\$ 518.6M	\$ 676.9M	\$ 518.6M
Investment PM Baseline (less airframe & initial provisioning)	489.5	565.5	489.5	565.5
Study Team: airframe estimate	1130.5*	1130.5*	1130.5*	1130.5*
Study Team: airframe initial provisioning	242.4	242.4	242.4	242.4
Operating PM/Study Team-All except tactical military personnel & replenishment spares	148.5(PM)	148.5(PM)	222.9(Study Team)	222.9(Study Team)
Study Team-tactical military personnel	204.3	204.3	306.5	306.5
PM/Study Team replenishment spares	284.7(PM)	284.7(PM)	427.0(Study Team)	427.0(Study Team)
LCC TOTAL	\$3176.8M	\$3094.5M	\$3495.7M	\$3413.4M

*\$1130.5M consists of CER results of \$1064.4M + \$48.0M (to allow for new material and MAD)=\$1094.4M X 1.033 (to adjust for range of values from -10% to +20%)=\$1130.5M

**These costs may be compared with AMC's Baseline Cost Estimates found in Appendix C.

5. The difference in the cost estimates are as follows (for 100 aircrafts):

(a) Study Team/ AMC IPCE:	10 Operating Years		15 Operating Years	
	Classic	LRIP	Classic	LRIP
Study Team Est.	$3152.2M	$3095.5M	$347.0M	$3414.3M
AMC IPCE	2952.1	2899.8	3257.1	3204.8
Study Team Increase	$ 200.1M	$ 195.7M	$ 213.9M	$ 209.5M

(b) Study Team/ P.M. BCE:				
Study Team Est.	$3152.2M	$3095.5M	$3471.0M	$3414.3M
P.M. BCE	2856.8	2898.5	3159.0	3200.7
Study Team Increase	$ 295.4M	$ 197.0M	$ 312.0M	$ 213.6M

Of course, the above differences would be greater if the current AMC IPCE and P.M. BCE estimates for 10 operating years were compared to the study team projection for 15 operating years (the range of increases would then be $518.9M to $614.2M).

6. The ASARC can use the cost framework shown below, for a production of 75 HLH, to obtain a total life cycle cost figure which can then be compared to the AMC IPCE or P.M. BCE, as desired. The omitted cost estimates would have to be extracted from the AMC IPCE or P.M. BCE and added to the study team estimates to obtain a comparable life cycle cost.

Study Team Estimate (75 HLH)
(in millions of FY74 dollars)

	10 Operating Years		15 Operating Years	
	Classic	LRIP	Classic	LRIP
R&D-AMC IPCE	( )*	( )*	( )*	( )*
Investment AMC IPCE-less airframe & initial provisioning	( )*	( )*	( )*	( )*
Study Team-airframe	936.5**	936.5**	936.5**	936.5**
Study Team-airframe initial provisioning	186.7	186.7	186.7	186.7
Operating Study Team-all except tactical military personnel & replenishment spares	110.2	110.2	165.3	165.3
Study Team-tactical Military personnel	158.9	158.9	238.4	238.4
Study Team-replenishment spares	211.0	211.0	316.5	316.5
LCC TOTAL	( )	( )	( )	( )

*Thruput costs to be obtained from the new AMC IPCE or P.M. BCE which have not yet reached HQ DA.

**$936.5M consists of CER results of $870.6M + 36.0M (to allow for new material and MAD)=$906.6M X 1.033 (to adjust for range of values from - 10% to + 20%)= $936.5M.

VI. RECOMMENDATIONS

The ASARC should consider the selected cost estimates described in this study as a means of evaluating the AMC IPCE and Project Manager's BCE cost estimates for HLH production quantities of 75 and 100 and for HLH fleet operating life of 10 operating years and 15 operating years.

APPENDIX A

COST ELEMENTS WHICH HAVE NOT BEEN EVALUATED IN DETAIL

TABLE 3

AMC IPCE COST ELEMENTS WHICH HAVE NOT BEEN EXAMINED IN DETAIL

(In Millions of FY 74 $)

Life Cycle Phase	Cost Element	Classic R&D Approach (with R&M and 2d Prototype)	Classic R&D Approach (without R&M and 2d Prototype)	LRIP
R&D	Engineering, Contractor, System Common/Other	$ 27.2	$ 27.2	$27.2
	Prototype Production, Contractor, Guidance & Control/Commo	0.8	0.8	0.4
	Prototype Production, Contractor, Peculiar Spt Equip.	4.4	4.4	2.5
	System Test & Eval, Contractor, System Common/Other	21.0	21.0	-
	System T&E, Government, System Common/Other	16.9	16.9	18.4
	Data, System Common/Other	5.0	5.0	5.0
	System Management, Govt System Common/Other	33.1	33.1	25.0
	Training, System Common/Other	7.1	7.1	7.1

TABLE 3 (Continuation)

Life Cycle Phase	Cost Element	Classic R&D Approach (With R&M and 2d Prototype)	LRIP
INVESTMENT	(Quantity)	(100)	(100)
	Production Base Spt, Propulsion	$ 20.6	$ 22.0
	Data, Contractor, System Common/Other	30.0	34.1
	Production, Contractor, Guidance & Control/Commo	13.5	13.5
	Production, Contractor Peculiar Spt Equipment	3.0	3.0
	Initial Provisioning, Contractor, Guidance & Control/Commo	2.0	2.0
	Initial Provisioning, Contractor, Peculiar Support Equipment	0.7	0.7
	Initial Provisioning, Contractor, Common Support Equipment	14.4	15.0
	Modifications, Contractor, System Common/Other	20.0	20.0
	Systems Mgmt, Government, System Common/Other	9.5	9.5
	Construction, Contractor, System Common/Other	0.7	0.7
	Transportation, System Common/Other	1.7	1.7
	Training, Contractor, System Common/Other	23.6	23.6

TABLE 4

BASELINE COST ELEMENTS WHICH HAVE NOT BEEN EXAMINED IN DETAIL

(In Millions of FY 74 $)

Life Cycle Phase	Cost Element	Classic R&D Approach (with R&M and 2d Prototype)	Classic R&D Approach (without R&M and 2d Prototype)	LRIP
R&D	Engineering, Contractor, System Common/Other	27.2	27.2	27.2
	Prototype Production, Contractor, Guidance and Control/Commo	0.8	0.6	0.4
	Prototype Production, Contractor, Peculiar Support Equipment	4.4	4.2	0.5
	System Test and Evaluation, Contractor, System Common/Other	21.0	21.0	-
	System Test and Evaluation Government, System Common/Other	16.9	16.9	18.4
	Data, System Common/Other	5.0	5.0	-
	Systems Management, Government, System Common/Other	29.5	28.5	22.6
	Training, System Common/Other	7.1	7.1	7.1

TABLE 4 (Continuation)

Life Cycle Phase	Cost Element	Classic R&D Approach (With R&M and 2d Prototype)	LRIP
INVESTMENT	(Quantity)	(100)	(100)
	Production Base Support, Propulsion	$ 32.0	$ 43.0
	Data, Contractor, System Common/Other	30.0	33.0
	Production, Contractor, Guidance & Control/Commo	13.5	13.5
	Production, Contractor, Peculiar Support Equip	3.0	3.0
	Initial Provisioning, Contractor, Guidance & Control/Commo	2.1	2.1
	Initial Provisioning, Contractor, Peculiar Support Equipment	0.7	0.7
	Initial Provisioning, Contractor, Common Support Equipment	13.0	13.0
	Modifications, Contractor, System Common/Other	39.0	44.0
	Systems Mgmt, Government, System Common/Other	9.5	9.5
	Construction, Contractor, System Common/Other	1.0	0.7
	Transportation, System Common/Other	1.7	1.7
	Training, Contractor, System Common/Other	24.0	24.0

APPENDIX B

FIELD IPCE COSTS IN LIFE CYCLE FORMAT FOR PROCUREMENT QUANTITY OF 100 AND BY DEVELOPMENT CONCEPTS OF CLASSIC R&D (WITH RELIABILITY & MAINTAINABILITY AND A SECOND PROTOTYPE), CLASSIC R&D (WITHOUT RELIABILITY & MAINTAINABILITY AND WITHOUT A SECOND PROTOTYPE), AND LOW RATE INITIAL PRODUCTION (LRIP).

[illegible]
DATE: [illegible]

AMC IPCE COSTS, 100 AIRCRAFT, 10 OPN. YEARS,
CLASSIC R&D WITH R&M & 2D PROTOTYPE
(WITHOUT R&M & 2D PROTOTYPE — SAME AMOUNTS)

TOTAL SYSTEM COST: 2952.1

STATIC COSTS, BY [illegible]

MILLIONS OF CONSTANT [illegible] DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID NAVIG (3)	PAYLOAD [illegible] (4)	FIRE CNTRL (5)	ARMAMT (6)	REC SPT (7)	[illegible] SPT (8)	SYS [illegible] (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	424.2	140.1	6.6	0.	0.	0.	4.4	0.	119.3	[illegible]	[illegible]
ENGINEERING (R)	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	15.8
CONTRACTOR	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	15.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	101.8	[illegible]	[illegible]	0.	0.	0.	4.4	0.	0.	135.8	4.6
CONTRACTOR	101.8	[illegible]	[illegible]	0.	0.	0.	4.4	0.	0.	135.8	4.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	37.9	37.9	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	21.0	21.0	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	16.9	16.9	0.6
DATA	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	[illegible]
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	33.1	33.1	1.1
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	33.1	33.1	1.1
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1271.8	202.1	[illegible]	0.	0.	0.	3.7	80.0	[illegible]	[illegible]	[illegible]
PROD ENG SPT (NON-R)	[illegible]	[illegible]	0.	0.	0.	0.	0.	0.	[illegible]	109.5	3.7
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY [illegible] (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	1.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	1.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	934.8	[illegible]	13.5	0.	0.	0.	3.0	80.0	0.	[illegible]	39.4
CONTRACTOR	934.8	[illegible]	[illegible]	0.	0.	0.	3.0	80.0	0.	[illegible]	[illegible]
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT. PROVISIONING (R)	198.3	[illegible]	[illegible]	0.	0.	0.	3.7	14.4	0.	301.4	[illegible]
CONTRACTOR	198.3	[illegible]	[illegible]	0.	0.	0.	3.7	14.4	0.	301.4	[illegible]
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	20.0	20.0	0.7
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	20.0	20.0	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS MGT (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.6	9.6	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.9	[illegible]	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	23.6	23.6	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	23.6	23.6	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	609.5	609.5	20.6
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	174.1	174.1	5.9
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	372.3	372.3	12.6
[illegible] SPARES	0.	0.	0.	0.	0.	0.	0.	0.	289.7	289.7	9.8
POL	0.	0.	0.	0.	0.	0.	0.	0.	67.0	67.0	2.3
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	4.7	4.7	0.2
DEPOT MAINT [illegible]	0.	0.	0.	0.	0.	0.	0.	0.	35.5	35.5	1.2
CONTRACT	0.	0.	0.	0.	0.	0.	0.	0.	35.5	35.5	1.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT [illegible] OPNS	0.	0.	0.	0.	0.	0.	0.	0.	17.9	17.9	0.6
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	17.9	17.9	0.6
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1700.0	342.4	16.2	0.	0.	0.	[illegible]	80.0	809.3	2952.1	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1700.0	342.4	16.2	0.	0.	0.	[illegible]	80.0	809.3	2952.1	100.0

REPORT 1
DATE [illegible]

ARC IPCE COSTS, 100 AIRCRAFT, 15 OPN. YEARS,
CLASSIC R&D WITH R&M & 2D PROTOTYPE

(WITHOUT R&M & 2D PROTOTYPE - SAME AMOUNTS)

[illegible]
100-15
TOTAL SYSTEM COST: 3257.1

STATIC COSTS, BY FULL [illegible]

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	AVIO COM (3)	PAYLOAD ARMAM (4)	FIRE CNTL (5)	ARM'T (6)	PEC SPT (7)	OTH SPT (8)	SYS LEV OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	428.2	140.3	0.	0.	0.	0.	4.4	0.	110.3	684.0	21.0
ENGINEERING	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	14.3
CONTRACTOR	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	14.3
GOVT. (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	101.8	[illegible]	0.8	0.	0.	0.	4.4	0.	0.	135.8	4.2
CONTRACTOR	101.8	[illegible]	0.8	0.	0.	0.	4.4	0.	0.	135.8	4.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	37.9	37.9	1.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	21.0	21.0	0.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	16.9	16.9	0.5
DATA	0.	0.	0.	0.	0.	0.	0.	0.	5.0	5.0	0.2
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	33.1	33.1	1.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	33.1	33.1	1.0
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1271.8	202.1	15.3	0.	0.	0.	3.7	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.	0.	0.	0.	0.	0.	0.	[illegible]	3.4
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	0.9
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	0.9
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	984.6	95.5	13.5	0.	0.	0.	3.0	65.6	0.	1162.2	35.7
CONTRACTOR	984.6	95.5	13.5	0.	0.	0.	3.0	65.6	0.	1162.2	35.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	198.3	86.0	2.0	0.	0.	0.	0.7	14.4	0.	301.4	9.3
CONTRACTOR	198.3	86.0	2.0	0.	0.	0.	0.7	14.4	0.	301.4	9.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	20.0	20.0	0.6
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	20.0	20.0	0.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS MGT (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.1	1.1	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	23.6	23.6	0.7
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	23.6	23.6	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	914.5	914.5	28.1
TACTICAL [illegible]	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	264.2	[illegible]
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	17.1
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	427.1	427.1	13.1
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	131.4	131.4	4.0
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	1.1	1.1	[illegible]
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	57.5	[illegible]	[illegible]
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	57.5	[illegible]	[illegible]
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SYS SPT	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPER	0.	0.	0.	0.	0.	0.	0.	0.	26.9	26.9	[illegible]
GENERAL SUPPORT	0.	0.	0.	0.	0.	0.	0.	0.	26.9	26.9	[illegible]
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS ASC)	[illegible]	342.4	15.3	0.	0.	0.	8.1	[illegible]	1110.3	3257.1	100.0
ASC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(INCL ASC)	[illegible]	342.4	15.3	0.	0.	0.	8.1	[illegible]	1110.3	3257.1	100.0

REPORT 1
DATE: 03/[illegible]/74

AMC IPCE COSTS, 100 AIRCRAFT, 10 OPN. YEARS
LOW RATE INITIAL PRODUCTION

L[illegible]
100-10
TOTAL SYSTEM COST: [illegible]

STATIC COSTS, BY [illegible]

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID ACFT (3)	PAYLOAD [illegible] (4)	FIRE CNTL (5)	ARM'T (6)	PSE SPT (7)	[illegible] SPT (8)	SYS COST OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	357.3	103.3	0.4	0.	0.	0.	2.5	0.	82.5	546.0	18.8
ENGINEERING	323.0	93.5	0.	0.	0.	0.	0.	0.	27.2	443.7	15.3
CONTRACTOR	323.0	93.5	0.	0.	0.	0.	0.	0.	27.2	443.7	15.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	34.3	9.8	0.4	0.	0.	0.	2.5	0.	0.	47.0	1.6
CONTRACTOR	34.3	9.8	0.4	0.	0.	0.	2.5	0.	0.	47.0	1.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	15.4	15.4	0.5
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	15.4	15.4	0.5
DATA	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	[illegible]	0.2
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	25.0	25.0	0.9
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	25.0	25.0	0.9
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1299.6	252.2	15.5	0.	0.	0.	3.7	83.3	89.6	1744.1	60.1
PROD BASE SPT (NON-R)	94.5	22.0	0.	0.	0.	0.	0.	0.	0.	116.5	4.0
ENGIN [illegible] (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	34.1	34.1	1.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	34.1	34.1	1.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	1003.2	121.2	13.5	0.	0.	0.	3.0	68.3	0.	1209.2	41.7
CONTRACTOR	1003.2	121.2	13.5	0.	0.	0.	3.0	68.3	0.	1209.2	41.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	202.1	109.0	2.0	0.	0.	0.	0.7	15.0	0.	328.8	11.3
CONTRACTOR	202.1	109.0	2.0	0.	0.	0.	0.7	15.0	0.	328.8	11.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	20.9	20.9	0.7
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	20.9	20.9	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TST (R)	0.	0.	0.	0.	0.	0.	0.	0.	8.6	8.6	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	8.6	8.6	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	23.6	23.6	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	23.6	23.6	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	609.5	609.5	21.0
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	175.1	175.1	6.0
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	372.3	372.3	12.8
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	284.5	284.5	9.8
POL	0.	0.	0.	0.	0.	0.	0.	0.	87.8	87.8	3.0
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	4.7	4.7	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	17.9	17.9	0.6
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	17.9	17.9	0.6
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1657.1	355.5	15.9	0.	0.	0.	6.2	83.3	781.6	2899.6	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1657.1	355.5	15.9	0.	0.	0.	6.2	83.3	781.6	2899.6	100.0

REPORT 1
DATE: 05/30/7[illegible]

AMC IPCE COSTS, 100 AIRCRAFT, 15 OPN YEARS,
LOW RATE INITIAL PRODUCTION

LIPCO
100-15
TOTAL SYSTEM COST: 3204.[illegible]

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID &COM (3)	PAYLOAD &ARMT (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SPT (8)	SYS OTH &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	357.3	103.3	0.4	0.	0.	0.	2.5	0.	82.7	546.2	[illegible]
ENGINEERING	323.0	93.5	0.	0.	0.	0.	0.	0.	27.2	443.7	13.8
CONTRACTOR	323.0	93.5	0.	0.	0.	0.	0.	0.	27.2	443.7	13.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	27.2	443.7	13.8
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	34.3	9.[illegible]	0.4	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	34.3	9.8	0.6	0.	0.	0.	2.5	0.	0.	47.0	1.5
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	2.5	0.	0.	47.0	1.5
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	18.4	18.4	0.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	18.4	18.4	0.6
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	5.0	5.0	0.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	25.0	25.0	[illegible]
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	25.0	25.0	0.8
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1299.8	252.2	15.5	0.	0.	0.	3.7	81.3	[illegible]	1744.1	[illegible]
PROD SUPPORT (NON-R)	94.5	22.0	0.	0.	0.	0.	0.	0.	[illegible]	116.5	[illegible]
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	34.1	34.1	1.1
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	34.1	34.1	1.1
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	1003.2	121.2	13.5	0.	0.	0.	3.0	61.3	0.	1209.2	37.7
CONTRACTOR	1003.2	121.2	13.5	0.	0.	0.	3.0	61.3	0.	1209.2	37.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	202.1	109.0	7.0	0.	0.	0.	3.7	15.0	0.	[illegible]	10.3
CONTRACTOR	202.1	109.0	7.0	0.	0.	0.	3.7	15.0	0.	[illegible]	10.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	20.0	20.0	0.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	20.0	20.0	0.6
SYS ACQ (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	23.8	23.8	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	23.8	23.8	0.7
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	914.6	[illegible]
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	264.2	264.2	8.2
COMB SPARES	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]	356.5	[illegible]
POL	0.	0.	0.	0.	0.	0.	0.	0.	427.1	427.1	13.3
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	131.4	131.4	4.1
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	57.8	[illegible]	1.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT OP. OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	25.9	25.9	0.8
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	25.9	25.9	0.8
TOT SYS COST(LESS ABC)	1657.1	355.5	15.9	0.	0.	0.	6.2	83.3	[illegible]	3204.[illegible]	100.0
ABC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH ABC)	1657.1	355.5	15.9	0.	0.	0.	6.2	83.3	[illegible]	3204.[illegible]	100.0

APPENDIX C

PROJECT MANAGER'S BASELINE COSTS IN LIFE CYCLE FORMAT FOR PROCUREMENT QUANTITY OF 100 AND BY DEVELOPMENT CONCEPTS OF CLASSIC R&D (WITH RELIABILITY AND MAINTAINABILITY AND A SECOND PROTOTYPE), CLASSIC R&D (WITHOUT RELIABILITY AND WITHOUT A SECOND PROTOTYPE), AND LOW RATE INITIAL PRODUCTION (LRIP).

REPORT 1
DATE: 08/08/74

BASELINE COSTS, 100 AIRCRAFT, 10 OPN. YEARS, CLASSIC R&D WITH R&M & 2D PROTOTYPE

CASE
100-10
TOTAL SYSTEM COST: 2856.8

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID ACQN (3)	PAYLOAD &AMMO (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SPT (8)	SYS CON &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	424.3	140.7	0.8	0.	0.	0.	4.4	0.	106.7	676.9	23.7
ENGINEERING	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	16.3
CONTRACTOR	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	16.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	97.9	29.2	0.8	0.	0.	0.	4.4	0.	0.	132.3	4.6
CONTRACTOR	97.9	29.2	0.8	0.	0.	0.	4.4	0.	0.	132.3	4.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	37.9	37.9	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	21.0	21.0	0.7
GOV. (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	16.9	16.9	0.6
DATA	0.	0.	0.	0.	0.	0.	0.	0.	5.0	5.0	0.2
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	29.5	29.5	1.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	29.5	29.5	1.0
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1184.2	195.0	15.6	0.	0.	0.	3.7	72.0	105.2	1575.7	55.2
PROD BASE SPT (NON-R)	98.0	32.0	0.	0.	0.	0.	0.	0.	0.	130.0	4.6
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	1.1
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	1.1
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	36.5
CONTRACTOR	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	36.5
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	10.4
CONTRACTOR	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	10.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.4
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS MGT (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	604.2	604.2	21.1
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	170.9	170.9	6.0
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	372.3	372.3	13.0
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	234.7	234.7	10.0
POL	0.	0.	0.	0.	0.	0.	0.	0.	87.6	87.6	3.1
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	4.7	4.7	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	17.6	17.6	0.6
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	17.8	17.6	0.6
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1608.5	335.7	16.4	0.	0.	0.	8.1	72.0	816.1	2856.8	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1608.5	335.7	16.4	0.	0.	0.	8.1	72.0	816.1	2856.8	100.0

REPORT 1
DATE: 08/08/74

BASELINE COSTS, 100 AIRCRAFT, 15 OPN. YEARS,
CLASSIC R&D WITH RAM & 2D PROTOTYPE

CHASE
100-15
TOTAL SYSTEM COST: 3159.0

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID &COM (3)	PAYLOAD &AMMO (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SPT (8)	SYS COM &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	424.3	140.7	0.8	0.	0.	0.	4.4	0.	106.7	676.9	21.4
ENGINEERING	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	14.7
CONTRACTOR	326.4	111.5	0.	0.	0.	0.	0.	0.	27.2	465.1	14.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	97.9	29.2	0.8	0.	0.	0.	4.4	0.	0.	132.3	4.2
CONTRACTOR	97.9	29.2	0.8	0.	0.	0.	4.4	0.	0.	132.3	4.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	37.9	37.9	1.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	21.0	21.0	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	16.9	16.9	0.5
DATA	0.	0.	0.	0.	0.	0.	0.	0.	5.0	5.0	0.2
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	29.5	29.5	0.9
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	29.5	29.5	0.9
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1184.2	195.0	15.6	0.	0.	0.	3.7	72.0	105.2	1575.7	49.9
PROD BASE SPT (NON-R)	98.0	32.0	0.	0.	0.	0.	0.	0.	0.	130.0	4.1
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	0.9
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	0.9
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	33.0
CONTRACTOR	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	33.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	9.4
CONTRACTOR	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	9.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS NOT (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	906.4	906.4	28.7
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	256.4	256.4	8.1
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	558.5	558.5	17.7
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	427.1	427.1	13.5
POL	0.	0.	0.	0.	0.	0.	0.	0.	131.4	131.4	4.2
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	7.0	7.0	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	26.7	26.7	0.8
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	26.7	26.7	0.8
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1608.5	335.7	16.4	0.	0.	0.	8.1	72.0	1118.3	3159.0	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1608.5	335.7	16.4	0.	0.	0.	8.1	72.0	1118.3	3159.0	100.0

REPORT 1
DATE: 04/08/74

BASELINE COSTS, 100 AIRCRAFT, 10 OPN. YEARS,
CLASSIC R&D WITHOUT R&A & 2D PROTOTYPE

NOBASE
100-10
TOTAL SYSTEM COST: 2866.8

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID &COM (3)	PAYLOAD &AMMO (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SPT (8)	SYS CTR &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	432.2	144.2	0.6	0.	0.	0.	4.2	0.	105.7	686.9	24.0
ENGINEERING	332.7	114.2	0.	0.	0.	0.	0.	0.	27.2	474.1	16.5
CONTRACTOR	332.7	114.2	0.	0.	0.	0.	0.	0.	27.2	474.1	16.5
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	99.5	30.0	0.6	0.	0.	0.	4.2	0.	0.	134.3	4.7
CONTRACTOR	99.5	30.0	0.6	0.	0.	0.	4.2	0.	0.	134.3	4.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	37.9	37.9	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	21.0	21.0	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	16.9	16.9	0.6
DATA	0.	0.	0.	0.	0.	0.	0.	0.	5.0	5.0	0.2
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	28.5	28.5	1.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	28.5	28.5	1.0
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1184.2	195.0	15.6	0.	0.	0.	3.7	72.0	105.2	1575.7	55.0
PROD BASE SPT (NON-R)	98.0	32.0	0.	0.	0.	0.	0.	0.	0.	130.0	4.5
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	1.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	1.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	36.4
CONTRACTOR	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	36.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	10.4
CONTRACTOR	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	10.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.4
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS MGT (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	604.2	604.2	21.1
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	170.9	170.9	6.0
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	372.3	372.3	13.0
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	284.7	284.7	9.9
POL	0.	0.	0.	0.	0.	0.	0.	0.	87.6	87.6	3.1
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	4.7	4.7	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	17.8	17.8	0.6
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	17.8	17.8	0.6
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1616.4	339.2	16.2	0.	0.	0.	7.9	72.0	815.1	2866.8	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1616.4	339.2	16.2	0.	0.	0.	7.9	72.0	815.1	2866.8	100.0

REPORT 1
DATE: 08/08/74

BASELINE COSTS, 100 AIRCRAFT, 15 OPN. YEARS,
CLASSIC R&D WITHOUT R&M & 2D PROTOTYPE

NGBASE
100-15
TOTAL SYSTEM COST: 3169.0

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID ACOM (3)	PAYLOAD &AMMO (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SPT (8)	SYS O/H &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	432.2	144.2	0.6	0.	0.	0.	4.2	0.	105.7	686.9	21.7
ENGINEERING	332.7	114.2	0.	0.	0.	0.	0.	0.	27.2	474.1	15.0
CONTRACTOR	332.7	114.2	0.	0.	0.	0.	0.	0.	27.2	474.1	15.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	99.5	30.0	0.6	0.	0.	0.	4.2	0.	0.	134.3	4.2
CONTRACTOR	99.5	30.0	0.6	0.	0.	0.	4.2	0.	0.	134.3	4.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	37.9	37.9	1.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	21.0	21.0	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	16.9	16.9	0.5
DATA	0.	0.	0.	0.	0.	0.	0.	0.	5.0	5.0	0.2
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	28.5	28.5	0.9
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	28.5	28.5	0.9
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1184.2	195.0	15.6	0.	0.	0.	3.7	72.0	105.2	1575.7	49.7
PROD BASE SPT (NON-R)	98.0	32.0	0.	0.	0.	0.	0.	0.	0.	130.0	4.1
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	0.9
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	30.0	30.0	0.9
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	32.9
CONTRACTOR	882.0	86.0	13.5	0.	0.	0.	3.0	59.0	0.	1043.5	32.9
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	9.4
CONTRACTOR	204.2	77.0	2.1	0.	0.	0.	0.7	13.0	0.	297.0	9.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.2
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	39.0	39.0	1.2
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS MGT (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	1.0	1.0	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	906.4	906.4	28.6
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	256.4	256.4	8.1
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	558.5	558.5	17.6
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	427.1	427.1	13.5
POL	0.	0.	0.	0.	0.	0.	0.	0.	131.4	131.4	4.1
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	7.0	7.0	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	26.7	26.7	0.8
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	26.7	26.7	0.8
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1616.4	339.2	16.2	0.	0.	0.	7.9	72.0	1117.3	3169.0	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1616.4	339.2	16.2	0.	0.	0.	7.9	72.0	1117.3	3169.0	100.0

REPORT 1
DATE: 03/08/74

BASELINE COSTS, 100 AIRCRAFT, 10 OPN. YEARS,
LOW RATE INITIAL PRODUCTION

EBASE
100-10
TOTAL SYSTEM COST: 2898.5

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID &COM (3)	PAYLOAD &AMMO (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SPT (8)	SYS COM &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	349.1	103.3	0.4	0.	0.	0.	0.5	0.	65.3	518.6	17.9
ENGINEERING	314.8	93.5	0.	0.	0.	0.	0.	0.	17.2	425.5	14.7
CONTRACTOR	314.8	93.5	0.	0.	0.	0.	0.	0.	17.2	425.5	14.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	34.3	9.8	0.4	0.	0.	0.	0.5	0.	0.	45.0	1.6
CONTRACTOR	34.3	9.8	0.4	0.	0.	0.	0.5	0.	0.	45.0	1.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	18.4	18.4	0.6
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	18.4	18.4	0.6
DATA	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	22.6	22.6	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	22.6	22.6	0.8
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1322.2	249.3	15.6	0.	0.	0.	3.7	72.0	112.9	1775.7	61.3
PROD BASE SPT (NON-R)	112.0	43.0	0.	0.	0.	0.	0.	0.	0.	155.0	5.3
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	33.0	33.0	1.1
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	33.0	33.0	1.1
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	992.0	108.6	13.5	0.	0.	0.	3.0	59.0	0.	1176.1	40.6
CONTRACTOR	992.0	108.6	13.5	0.	0.	0.	3.0	59.0	0.	1176.1	40.6
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	218.2	97.7	2.1	0.	0.	0.	0.7	13.0	0.	331.7	11.4
CONTRACTOR	218.2	97.7	2.1	0.	0.	0.	0.7	13.0	0.	331.7	11.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	44.0	44.0	1.5
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	44.0	44.0	1.5
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS T&E (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	604.2	604.2	20.8
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	170.9	170.9	5.9
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	372.3	372.3	12.8
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	284.7	284.7	9.8
POL	0.	0.	0.	0.	0.	0.	0.	0.	87.6	87.6	3.0
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	4.7	4.7	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	38.5	38.5	1.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	17.8	17.8	0.6
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	17.8	17.8	0.6
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1671.3	352.6	16.0	0.	0.	0.	4.2	72.0	782.4	2898.5	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1671.3	352.6	16.0	0.	0.	0.	4.2	72.0	782.4	2898.5	100.0

REPORT 1 BASELINE COSTS, 100 AIRCRAFT, 15 OPN. YEARS, LOW RATE INITIAL PRODUCTION LBASE 100-15
DATE: 03/08/74 TOTAL SYSTEM COST: 3200.7

STATIC COSTS, BY FULL WBS

MILLIONS OF CONSTANT FY74 DOLLARS

COST ELEMENT	FRAME (1)	PROP (2)	GUID &COM (3)	PAYLOAD &AMMO (4)	FIRE CONTR (5)	ARM'T (6)	PEC SPT (7)	COM SYS SPT (8)	CON &OTHER (9)	TOTAL (10)	PER CENT (11)
RESEARCH & DEVELOPMENT	349.1	103.3	0.4	0.	0.	0.	0.5	0.	65.3	518.6	16.2
ENGINEERING	314.8	93.5	0.	0.	0.	0.	0.	0.	17.2	425.5	13.3
CONTRACTOR	314.8	93.5	0.	0.	0.	0.	0.	0.	17.2	425.5	13.3
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOOLING	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PROTOTYPE PRODUCTION	34.3	9.8	0.4	0.	0.	0.	0.5	0.	0.	45.0	1.4
CONTRACTOR	34.3	9.8	0.4	0.	0.	0.	0.5	0.	0.	45.0	1.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS TEST & EVAL	0.	0.	0.	0.	0.	0.	0.	0.	18.4	18.4	0.6
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	18.4	18.4	0.6
DATA	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYSTEMS MANAGEMENT	0.	0.	0.	0.	0.	0.	0.	0.	22.6	22.6	0.7
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	22.6	22.6	0.7
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDUSTRIAL FAC	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MIL CONST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRAINING	0.	0.	0.	0.	0.	0.	0.	0.	7.1	7.1	0.2
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INVESTMENT	1322.2	249.3	15.6	0.	0.	0.	3.7	72.0	112.9	1775.7	55.5
PROD BASE SPT (NON-R)	112.0	43.0	0.	0.	0.	0.	0.	0.	0.	155.0	4.8
ENGINEERING (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
QUALITY CONTROL (R)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DATA	0.	0.	0.	0.	0.	0.	0.	0.	33.0	33.0	1.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	33.0	33.0	1.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PRODUCTION (R)	992.0	108.6	13.5	0.	0.	0.	3.0	59.0	0.	1176.1	36.7
CONTRACTOR	992.0	108.6	13.5	0.	0.	0.	3.0	59.0	0.	1176.1	36.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INIT PROVISIONING(R)	216.2	97.7	2.1	0.	0.	0.	0.7	13.0	0.	331.7	10.4
CONTRACTOR	216.2	97.7	2.1	0.	0.	0.	0.7	13.0	0.	331.7	10.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS (R)	0.	0.	0.	0.	0.	0.	0.	0.	44.0	44.0	1.4
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	44.0	44.0	1.4
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SYS T&E (R)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	9.5	9.5	0.3
CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.7	0.7	0.0
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TRANSPORTATION (R)	0.	0.	0.	0.	0.	0.	0.	0.	1.7	1.7	0.1
TRAINING (R)	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.7
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	24.0	24.0	0.7
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATING	0.	0.	0.	0.	0.	0.	0.	0.	906.4	906.4	28.3
TACTICAL MIL PERS	0.	0.	0.	0.	0.	0.	0.	0.	256.4	256.4	8.0
CONSUMPTION	0.	0.	0.	0.	0.	0.	0.	0.	558.5	558.5	17.4
REPL SPARES	0.	0.	0.	0.	0.	0.	0.	0.	427.1	427.1	13.3
POL	0.	0.	0.	0.	0.	0.	0.	0.	131.4	131.4	4.1
TRANSPORTATION	0.	0.	0.	0.	0.	0.	0.	0.	7.0	7.0	0.2
DEPOT MAINTENANCE	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	57.8	57.8	1.8
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
MODIFICATIONS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
CONTRACTOR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GOVT (IN-HOUSE)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DIRECT SPT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
INDIRECT SUPPORT OPNS	0.	0.	0.	0.	0.	0.	0.	0.	26.7	26.7	0.8
CENTRAL SUPPLY	0.	0.	0.	0.	0.	0.	0.	0.	26.7	26.7	0.8
OTHER	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(LESS AEC)	1671.3	352.6	16.0	0.	0.	0.	4.2	72.0	1084.6	3200.7	100.0
AEC COST	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
TOT SYS COST(WITH AEC)	1671.3	352.6	16.0	0.	0.	0.	4.2	72.0	1084.6	3200.7	100.0

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

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